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Light and hens as attraction factors of *Nyssomyia whitmani* in a rural area, Southern Brazil

ABSTRACT

OBJECTIVE: To verify the influence of traps with electric light and hens as factors that attract sandflies and compare results between capture methods.

METHODS: The study was conducted in the Palmital Farm, Southern Brazil. Sandfly collections were conducted with Falcão traps and an electric aspirator, fortnightly, between 8 p.m. and 11 p.m. in the presence or absence of light and hens in peridomiciliary areas, from September 1998 to June 1999.

RESULTS: A total of 43,767 specimens from eight species of sandflies were collected: *Nyssomyia whitmani*, *N. neivai* and *Migonemyia migonei* constituting 99.9% of the total collected, with predominance of *N. whitmani*. The number of this species collected inside the hen's shed in the presence of hens (21,045) was greater than in their absence (10,434). In the presence of hens, with distinct intensities of light, a larger number of *N. whitmani* samples were collected with 3W light. In the presence of hens and light (3W), the number of *N. whitmani* collected with the electric aspirator (5,141) was superior to that collected with the Falcão trap (1,675). In the absence of light, with or without the presence hens, there was no difference between the numbers of *N. whitmani* collected with the electric aspirator or the Falcão trap.

CONCLUSIONS: Hens and electric light together attract more *N. whitmani* to peridomiciliary areas. The number of *N. whitmani* collected with an electric aspirator inside a hen's shed with the presence of hens and light is greater than those collected with a Falcão trap in the same conditions.

KEYWORDS: *Nyssomyia whitmani*. Psychodidae. Insect vectors. Data collection, methods. Leishmaniasis, epidemiology. Leishmaniasis, transmission.

INTRODUCTION

American tegumentary leishmaniasis (ATL) has occurred in all of the states of Brazil and is among the most important cutaneous infections in the country, with 552,059 cases notified between the period of 1980 to 2003.^{8,*} In the state of Paraná, 12,220 cases occurred during this period, mainly in the north and east, representing 99.3% of the cases in the South region.^{8,*}

The large presence of sandflies in the household, in rural areas in the north of Paraná where there have been many cases of ATL^{9,10,15-17} indicates that in other areas with similar environmental characteristics there is a risk of human and domestic animal infection of leishmaniasis.

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The collections of sandflies with light traps inside domestic animal habitats, as a general rule, have been very productive.^{9,15-17} However, they do not permit an evaluation of the importance of light and domestic animals, together or separately as attraction factors of sandflies.

The endemic character of ATL in Paraná shows a need to study the ecology of sandflies in the areas where this sickness occurs.¹³ The objective of the present study was to verify the influence of the light intensity and/or of hens, as attraction factors of sandflies and compare the results between capture methods.

METHODS

The area where the research was carried out is a peridomestic area a residual, altered forest, in the Palmital Farm, in the north of the Paraná (Southern Brazil), at 23°45'S and 52°26'W (Figure). In the deforested areas of the farm, the ground is primarily covered with soy, corn, and wheat plants.

The native vegetation is constituted of dense tropical forest in transition to subtropical, with a partial she-

dding of the leaves of some of the species in the winter. The climate is tropical, in transition to subtropical, with average annual temperatures around 23°C with harsh winters and barely pronounced dry periods in July and August. From 1988 to 1997, the average high temperature reached 30.8°C in 1992, and the average minimum was 15.6°C in 1988. On the hottest days of the year, the temperature can reach up to 41°C and on the coldest, it can drop to negative temperatures. The annual rain fall between 1988 and 1997 varied between 1.168 mm in 1988 and 2,216.4 mm in 1997, with an annual average of 1,766.1 mm. In the period from 1988 to 1997, the month with the highest average of rain was January (289.7 mm) and the lowest averages were in July (59.2 mm) and August (71.1 mm).

To study the interaction between light and hens, an existent wooden hen's shed was remodeled behind house 1 (C1). This shed, with 1.7m of height and 2.25m² of area, was located approximately 40m from the border of the forest (Figure). One of the four walls of the shed was made with wire mesh appropriate for the breeding of hens in captivity. During the collection of the sandflies with an electronic aspirator (EA), this wire mesh wall was covered with a white plastic curtain.

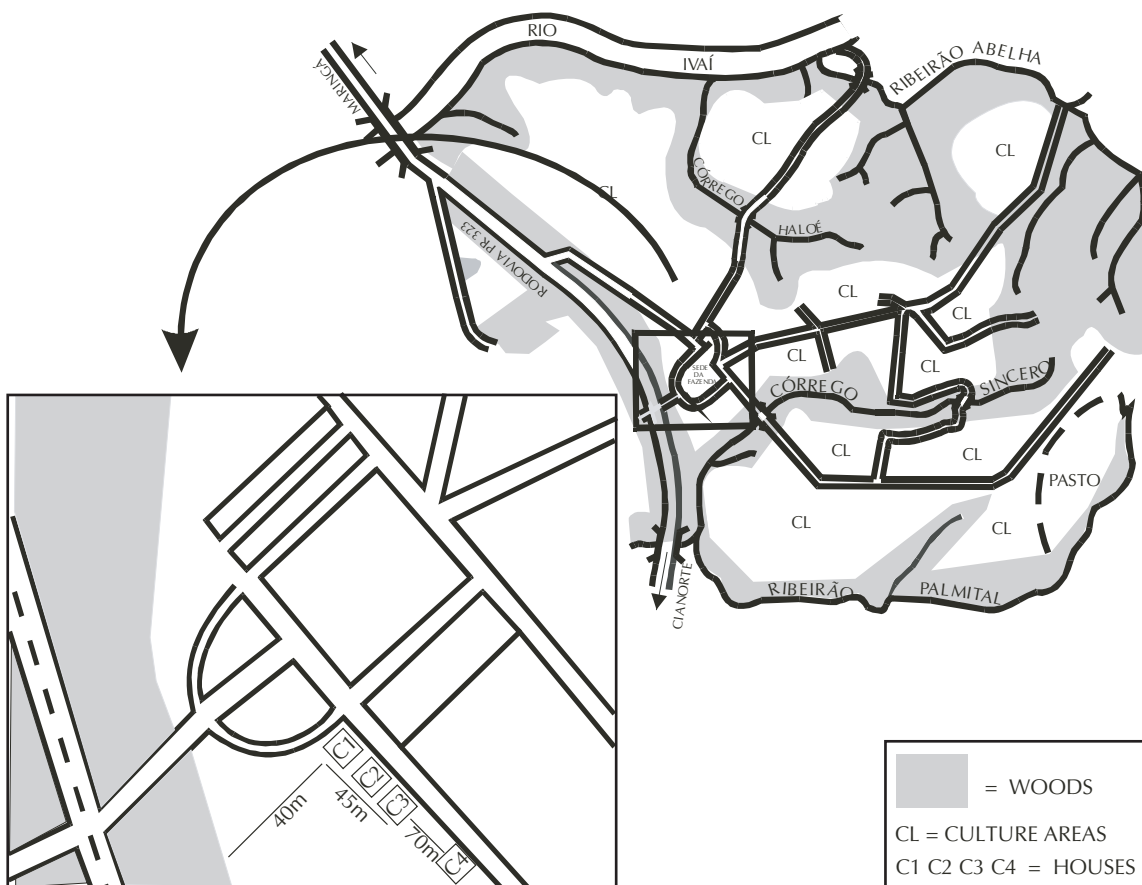


Figure. Sandfly collection locations in hen's sheds behind houses C1 and C3 and on the porch of house C4. Palmital Farm, Southern Brazil. September 1998 to June 1999.

Tabela 1. Number of *Nyssomyia whitmani* samples collected with distinct intensities of light in hen's shed. Palmital Farm, Southern Brazil. September 1998 to June 1999.

| Hens | Light intensity | | | Total |
|---------|--------------------|--------------------|--------------------|--------|
| | 60W | 3W | 0W | |
| Present | 7,625 ^a | 8,328 ^b | 5,092 ^c | 21,045 |
| Absent | 3,649 ^d | 3,218 ^e | 3,567 ^f | 10,434 |
| Total | 11,274 | 11,546 | 8,659 | 31,479 |

p<0.0001 (axbxcxdxexf)

p<0.0001 (axb); p<0.0001 (axc); p<0.0001 (bxc)

Tabela 2. Number of *Nyssomyia whitmani* collected in distinct light intensities and collection techniques in hen's shed. Palmital Farm, Southern Brazil. September 1998 to June 1999.

| Hens | 3W | | 0W | | Total |
|---------|--------------------|--------------------|--------------------|--------------------|--------|
| | EA | FT | EA | FT | |
| Present | 5,141 ^a | 3,187 ^c | 2,841 ^e | 2,251 ^g | 13,420 |
| Absent | 1,675 ^b | 1,543 ^d | 1,978 ^f | 1,589 ^h | 6,785 |
| Total | 6,816 | 4,730 | 4,819 | 3,840 | 20,205 |

EA = Eletric aspirator; FT = Falcão trap

p<0.0001 (axbxcxd); p=0.000 (axb); p=0.000 (cxd); p=0.000 (axc)

p=0.7535 (exfxgxh)

p<0.0001 (axbxexf); p=0.000 (axe); p=0.000 (exf)

p<0.0001 (cxgxdxh); p=0.000 (cxg); p=0.000 (gxh)

Tabela 3. Number of *Nyssomyia whitmani* samples collected with Falcão traps in the peridomiciliary area. Palmital Farm, Southern Brazil. September 1998 to June 1999.

| Light intensity | Environment | | | |
|-----------------|------------------|-------------------|-------|-------------------|
| | Inactivated shed | | Porch | |
| | N | HA | N | HA |
| 3W | 1,711 | 14.3 ^a | 2,188 | 18.2 ^c |
| 0W | 953 | 15.9 ^b | 876 | 14.6 ^d |
| Total | 2,664 | - | 3,064 | - |

p=0.1387 (axbxcxd)

HA: Hourly average

The sandfly collections were conducted with EA and the Falcão Trap (FT), in three consecutive nights, two times for month, from 8:00 pm to 11:00 pm from September 1998 to June 1999. In the first two-week period, the research was conducted in the presence of the hens (13 to 15 units) and in the other three nights, in their absence. In this way, a period of three nights of collection with the presence of the hens (90 h) was alternated with a one week break of a period of three nights of collection without the hens (90 h).

In the first night of collection, a 60W light was left lit. Following, the wall of wire mesh in the hen's shed was covered with a plastic curtain and the sandflies were collected on the internal walls with the EA during 30 to 40 min, totaling 30 h of collection in the presence of hens and 30 h in their absence (during the other two week period).

The second night, the FT was installed in the hen's shed and only a 3W light of the FT stayed lit. Immediately following, the FT was taken out and the wall of wire mesh in the hen's shed was covered to continue with the aspiration of the sandflies in the internal walls for 30 to 40 min. Thirty hours of collection were conducted in the presence of hens and 30 hours in their absence.

On the third night, the procedure was repeated, but with a lamp that was permanently turned off.

To study of the influence of light on the collection of sandflies in different peridomicilliary environments (Figure), a FT was installed in an inactivated hen's shed, behind house 3 (C3), approximately 45m from C1. Another FT was installed on the porch at the back of house 4 (C4), approximately 70m from C3. The collections were carried out from 8 to 11pm. In the two nights of the collection periods, the FT stayed lit with a 3W light (total of 120 hours collected) and the third night the collection was made with the FT turned off (total of 60 hours of collection). As the number of hours of collection was distinct, an hourly average (HA) of sandfly collection was used.

After the collection, the sandflies were accommodated in cardboard boxes, to be later identified. The sandflies were prepared and identified according to Forattini⁶ (1973). The nomenclature of the species of phlebotomines follows Galati⁷ (2003).

As the species *N. whitmani* represented 95.2% of the total sandflies collected, the statistical analysis was conducted considering only this species, using the Chi-square test, with a 5% level of significance and the assistance of the software program Statistica 6.0.

RESULTS

In Table 1, it is observed that eight species of sandflies with a total of 43,767 samples were collected in the three peridomiciliary environments of the Palmital Farm. The species *Nyssomyia whitmani*, *Nyssomyia neivai* and *Migonemyia migonei* represented 99.9% of the sandflies collected, with *N. whitmani* (95.2%) predominating.

In the analysis regarding the influence of light intensity and hens (Table 1), all of the samples of *N. whitmani* collected in the hen's shed, independent of the capturing technique (FT + AE), were considered. As such, this

table shows that: the number of *N. whitmani* collected was significantly higher in the presence of hens ($p < 0.0001$). The number of *N. whitmani* varied with light intensity in the presence of hens: those collected with 3W (8,328) was higher than that collected with 60W (7,625) ($p < 0.0001$), which itself was higher than that collected with 0W (5,092) ($p < 0.0001$).

In the analysis of the influence of the hens and light on the number of *N. whitmani* in the second collection technique (Table 2), the samples collected with EA and FT in the hen's shed were considered, with the 3W light of the FT turned on and off (0W) and both with and without the presence of hens. In the captures with the presence of hens, with the FT light lit (3W), the quantity of the *N. whitmani* collected with the EA was higher than that collected with the FT ($p < 0.0001$). It is of note that there was a significant difference ($p = 0.000$) between the number of the *N. whitmani* with EA, in the presence of hens (5,141 samples) and in their absence (1,675 samples). In the same way, the number of *N. whitmani* collected with the FT, in the presence of hens (3,187 samples), was higher ($p = 0.000$) than that in their absence (1,543 samples). In the comparison between techniques, in the presence of hens and the lamp lit (3W), the quantity of sandflies collected with the EA (5,141) was significantly higher ($p = 0.000$) to that collected with the FT (3,187).

In Table 2, observe that in the absence of light (0W), in any circumstance, when compared with the quantities of the *N. whitmani* collected with FT and EA, there was no significant difference between the results ($p = 0.735$).

The influence of light collected with *N. whitmani* was evaluated by the HA of samples collected in an inactivated hen's shed and an annex, with a FT lamp (3W) lit or turned off (0W). In Table 4, note that there was no significant difference between the HA of sandflies collected with 3W (HA=14) or 0W (HA=15) ($p = 0.1387$).

DISCUSSION

Few sandfly species were collected in the peridomestic environment. However, the quantity of samples was elevated. This is a fairly frequent finding in some antropic environments,^{3,10,16,17} including the location where the present study was conducted.¹⁵

The residential environment of the Palmital Farm is similar with other rural areas, where there is normally electric energy, domestic animals and humid ground that accumulates organic material. These create conditions which promote the formation of breeding places^{14,18} and a large concentration of sandflies in the household.^{10,15-17} The shelter of domestic animals, constructed near the household, increase the risk of transmission of LTA for humans and domestic animals.

As previously observed, the prevalence of *N. whitmani* in the three environments where the collections were made with this type of instrument are well adapted for the antropic environment. The species *M. migonei*, *N. neivai*, *P. fischeri* and *P. pessoai*, present in the same environments, in even smaller numbers, indicates that they are also in the process of adaptation to antropic environments.^{3,15-17} The species *N. whitmani*, *N. neivai* and *M. migonei*, have been constant in the households of rural areas in the north of Paraná.^{3,15-17} *N. whitmani* and *N. neivai* were associated with natural infection of Leishmaniasis in the states of Ceará^{1,2,11} and Rio de Janeiro¹² confirming this vector's potential in natural and antropic environments. In the north part of the state of Paraná, *Leishmania (Viannia) braziliensis* of *N. whitmani*⁹ is isolated.

The results show that hens and light together, attracted a larger number of sandflies to the hen's shed. When the results from Tables 1 and 2 are compared, it is clear that a larger number of sandflies were attracted to the hen's shed when the hens were present and when there was light on the inside, in particular with the 3W light. In the absence of hens, the sandflies were always collected in lower quantities, regardless of the intensity or presence of light. The results from Table 3 reinforce the importance of the presence of hens in attracting sandflies, yet no difference was observed between the HA of the sandflies collected in both environments, with 0W and 3W. The results support previous research conducted with light traps in domestic animal shelters.^{3,15-17} Campbell-Lendrum et al⁴ (1999) verified that of a total of 7,854 sandfly samples (7,328 *N. whitmani* and 526 *N. intermedia*), 75.9% were collected in CDC traps with different domestic animals and in the presence of light and the rest, in the absence of light.

There was a significant difference between the quantity of sandflies collected with distinct strengths of lantern light, with the largest number of insects being collected with the 3W lamp in the hen's presence. Campbell-Lendrum et al (2000)⁵ confirmed in experimental hen's sheds in the same location with different percentages of the shed closed off (0%, 33%, 67% and 98%), that as the percentage closed off increased, the number of female *N. whitmani* collected decreased and the number of males was highest with 33% of the hen's shed closed. These authors noted that light intensity did not affect *N. intermedia*'s entrance into the experimental hen's sheds.

The quantity of *N. whitmani* collected with EA was higher than that collected with the FT, in the presence of hens and light (3W). However, as the results collected with the FT showed a high concentration of sandflies in peridomestic areas,^{10,15-17} this trap could be used in entomologic surveillance, as the trap decreases the risk of infection of the people who collect the samples because they are less exposed to sandfly bites.

Hens, when associated with light, are factors which attract a higher number of *N. whitmani* to the peridomiciliary environment. In the same conditions, the collection with the EA is more productive than with the FT. In conclusion, in endemic areas of LTA, lit hen's sheds, at a certain distance from the household, could help in reduce the presence of sandflies in the areas within and surrounding the home.

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